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WIPER BLADE FOR CLEANING GLASS SURFACES ON VEHICLES,  
ESPECIALLY MOTOR VEHICLES

The invention relates to a wiper blade in accordance with primary patent claim 1.

Wiper blades for cleaning glass surfaces on vehicles are known in highly varied configurations. Among them the so-called flat wiper blades are particularly known; they consist basically of a wiper blade body manufactured from a flexible rubber material and of support splines or spring splines engaging in lateral longitudinal grooves in the wiper blade body, which are then attached at both ends of the wiper blade body along with it to the wiper blade by means of end caps (DE-A-197 39 256).

It is also known in the case of windshield wipers for the wiper blade body to be configured as an airfoil on its upper side facing away from the lip and thus from the glass surface to be cleaned, that is to say, with an inclined surface whose plane in the particular application includes an angle smaller than 90° with the plane of the glass surface, or with a correspondingly concave curved incline (DE-A 197 34 843).

It is additionally known for wiper blades to provide a distribution passage inside the wiper blade body extending in the longitudinal direction of the wiper blade for a cleaning or washing fluid, where discharge openings are provided at the end caps at both ends of the wiper blade to discharge the cleaning or washing fluid onto the glass surface.

One of the disadvantages of the known wiper blades of the type mentioned at the beginning is that the protruding areas or parts of the spring or carrier splines form relatively sharp edges, with a substantial risk of injury. Furthermore, these protruding parts have an especially negative aerodynamic effect on the behavior of the wiper blade and consequently of the windshield wiper at high speeds.

The object of the invention is to demonstrate a wiper blade which avoids these disadvantages. To achieve this object a wiper blade is configured in accordance with patent claim 1.

The part of the width of the carrier spline or spring spline protruding from the wiper blade body is covered by the profiled cover or molding respectively, so that the risk of injuries no longer exists. The profiled cover can be given an aerodynamically optimal form, especially on its exposed surfaces, so that even at high speed the result is optimal characteristics for the wiper blade furnished with at least one profiled cover.

In the case of the invention a profiled cover of this type is provided at least on the forward side of the wiper blade facing the direction of travel. The profiled cover can be manufactured in especially advantageous fashion from plastic, for example, also from softer or flexible plastic, in particular for example, as an extruded profile which is then cut to the required length in each case.

In the case of one embodiment of the invention, the front profiled cover, with respect to the direction of travel in this particular application, is configured as an airfoil on at least one partial surface, which also contributes to an improvement in the behavior of the wiper blade at high speeds.

Furthermore the potential exists of providing in at least one profiled cover at least one distribution passage with at least one discharge opening or nozzle orifice for a cleaning or washing fluid.

Further developments of the invention are the object of the subclaims. The invention is explained below in greater detail from embodiments using the figures.

Figure 1 shows in a simplified rendering a section through a wiper blade of a windshield wiper which is otherwise not shown;

Figure 2 shows a partial drawing of the windshield wiper in a side view;

Figure 3 shows in a simplified partial rendering a section through a wiper blade of a further possible embodiment of the invention.

The wiper blade 1 shown in Figures 1 and 2 consists of a basically familiar wiper blade body 2 which is manufactured as an airfoil from a flexible rubber material, and from two ribbon-shaped support or spring splines 3 holding the wiper blade body 2 between them, which are manufactured from a flexible material,

preferably from spring steel and which, like the wiper blade body 2, extend along the entire length of the wiper blade 1, which in the drawing selected for Figure 1 runs perpendicular to the drawing plane of the figure.

The cross-section of the wiper blade body 2 forms a section profile 4 with an underside 5 furnished by means of a flexible hinge 6 with the similarly formed-on lip 7, with which in the particular application the wiper blade 1 lies against the vehicle glass surface to be cleaned. Flexible hinge 6 and lip 7 similarly extend along the entire length of the wiper blade body 2. In the embodiment shown the flexible hinge 6 is formed approximately in the middle of the underside 5, specifically in center plane M which includes the longitudinal axis L of the wiper blade 1. The section profile 4 is furnished with a longitudinal groove on two longitudinal sides 8 and 9 which lie in planes perpendicular to the underside 5 in the embodiment shown. The former are open on the longitudinal sides 8 and 9 as well as on the two ends of the wiper blade body 2 and lie in a common plane parallel to the underside 5.

A spring spline 3 is located in each longitudinal groove 10 with one part of its width, with the other part of its width, that is, in the case of the embodiment shown about one half of its width, it protrudes out of the longitudinal groove 10 above the respective longitudinal side, 8 or 9. In the middle of the wiper blade 1, it is attached to the wiper arm of the windshield wiper, which is not shown, by means of an adapter that is likewise not shown, which also grips the spring splines 3. Further, end caps 11 are attached at both ends of the wiper blade, which connect the ends of the spring splines 3 there to each other as well as to the wiper blade body 2.

As Figure 1 also shows, the section profile 4 on the upper side of the wiper blade facing away from the lip 7 is configured as an airfoil, that is, one longitudinal side 9 is of a greater height than the other longitudinal side 8, the result being a sloping airfoil surface on the upper side of the wiper blade body 2 forming a concave curve around axes parallel to the longitudinal extent or longitudinal axis L of the wiper blade body 2.

On the protruding sections of the support or spring spline 3 projecting above the longitudinal sides 8 and 9, profiled covers 13, 14 respectively are mounted, which in the embodiment shown cover these projecting areas of the support splines 3 over their entire length, that is, extend right up to the two end caps 11. The profiled covers 13 and 14, which are preferably manufactured from plastic, wrap around the protruding areas of the carrier or spring splines 3 like claws, so that these areas are completely covered. For this purpose, the profiled covers 13 and 14 each have a longitudinal groove 15, 16 respectively, that is open to one longitudinal side of the respective profiled cover, 13 or 14 as well as at the two ends of this airfoil, and in which is located the respective protruding part of the spring spline 3.

In the longitudinal grooves, 15 and 16 respectively, catches are provided which in the embodiment shown are formed by projections 17, which act in conjunction with mating notches on the support or spring spline 3. In the embodiment shown, these mating notches are formed by openings 18, which the support or spring splines 3 have at least on the partial area protruding beyond the wiper blade body 2. With the projections 17 engaging in the openings 18, the profiled covers 13 and 14 are retained by latching onto the wiper blade 1. In the embodiment shown, the profiled cover 13 adjacent to the longitudinal side 8 is shaped in such a way that it forms an additional airfoil on its outside facing away from the wiper blade body 2, with airfoil surface 19 also forming a concave curve around axes running parallel to the longitudinal axis L, where in the cross-sectional drawing of Figure 1 a convex curved surface 20 adjoins the airfoil surface 19 and then changes into airfoil surface 20 by way of another surface 21.

As Figure 1 also shows, the surface 21 forms an extension of airfoil surface 12, so that on the one hand the airfoil surface 12 is enlarged and on the other hand an additional airfoil, or rather an additional airfoil surface 19, is created by the profiled cover 13. The airfoil surface 19 is formed at least partially on a projection 13' of the profiled cover 13, which (projection) extends beyond the underside 5 of the section profile 4.

In the embodiment shown a passage 22, 23 respectively is provided in each profiled cover 13, 14, which extends in the longitudinal direction of the profiled

cover 13, 14 respectively. The passages 22, 23 serve on the one hand to reduce the weight of the particular profiled cover. The passages 22 and 23 serve further specifically to distribute and deposit a cleaning or washing fluid on the vehicle glass to be cleaned. To do this, nozzle orifices 24, 25 respectively are provided on the profiled covers 13 and 14 opening into the particular passage 22, 23 respectively, specifically on the underside of the profiled cover facing the vehicle windshield or the lip 7 respectively such that the nozzle orifices 24, 25 respectively form an acute angle, that is an angle smaller than  $90^\circ$ , with the center plane M with their axis, and are located radially or roughly radially to the longitudinal extent of the specific passage 22, 23 respectively. The nozzle orifices 24 are arranged to be covered or protected from the slipstream by the projection 13'. To supply the cleaning agent an end cap 11 is configured as a connector with an internal passage which connects to the passages 22 and 23 as well to a source for the fluid cleaning agent (water, preferably water with cleaning and anti-freeze additives) by means of a hose 26. The other end cap 11 is then, for example, configured such that it closes off the two passages 22 and 23 at the appropriate end. As Figure 2 shows, as a result of the positioning of the passages 22 and 23, the corresponding discharge openings 24 and 25 are located at a relatively great distance from the center plane M and therefore from the lip 7, so the result is that the cleaning or wiper fluid deposited on the windshield has a long time to take effect.

Plastic or also a flexible rubber material, for example, flexible plastic are suitable as material for the profiled covers 13, 14. In the embodiment shown, profiled cover 13 is incorporated on the side of the wiper blade 1 which in the particular application forms the front side with reference to the direction of travel of the vehicle.

The cleaning or washing fluid can either be discharged simultaneously through the two passages 22 and 23 and the corresponding discharge openings 24 and 25, or the possibility also exists, with the windshield wipers switched on, of controlling the output depending on the direction of the wiper blade's motion in such a way that the output of cleaning or washing fluid always takes place through passage

22 or 23 respectively, or rather those discharge openings 24 and 25 which are moving ahead of the lip 7 with respect to the motion of the wiper blade 1.

Figure 3 shows as a further possible embodiment a wiper blade 1a, of which for the sake of simpler presentation only the spring spline 3 located on the right of the center plane M is shown together with a profiled cover 14a, which corresponds to the profiled cover 14 of the wiper blade 1, although it has a shape differing somewhat from profiled cover 14. Otherwise the wiper blade 1a is configured in the same way, particularly with respect to the wiper blade body 2, the support spline 3 and the profiled cover 13, as was described previously for the wiper blade 1.

As shown, in the area of its outer side 27, which forms the particular longitudinal side of the wiper blade and faces away from the wiper blade body 2, the profiled cover 14a is furnished with a strip-like face 14a' which in a similar way to the projection 13' of the profiled cover 13 extends with its open edge clearly beyond the underside of the remaining part of the profiled cover 14a facing the lip 7, and specifically, for example, as far as a plane E which is perpendicular to the center plane M, intersects the lip 7 below the flexible hinge 6, and on which or in the vicinity of which, for example, the open edge of the projection 13' is located. In the embodiment shown the outside of the face 14a' away from the lip 7 forms the continuation of the outside 27. The face 14a' extends over the entire length of the profiled cover 14a or over the entire or almost the entire length of the wiper blade 1a.

The profiled cover 14a once again has the passage 23 with the nozzle orifices 25, which however in this embodiment include an angle with the center plane M which is larger, compared with the corresponding angle of the nozzle orifices 25 for wiper blade 1.

As a result of the face 14a' there is a particularly favorable change in the airflow (among other things) such that specifically at the upper reversing point of the motion of the wiper blade, that is, in the vicinity of a vehicle's A-pillar during the inwipe stroke, or the downward motion, in which the longitudinal side of the wiper blade 1a with the face 14a' is trailing, the water which was wiped off the vehicle

windshield by the wiper blade during its upward motion, is prevented from running after the wiper blade 1a and thereby impairing vision.

## Reference Numeral List

|             |                                    |
|-------------|------------------------------------|
| 1           | Wiper blade                        |
| 2           | Wiper blade body                   |
| 3           | Support or spring spline           |
| 4           | Section profile                    |
| 5           | Underside of the section profile   |
| 6           | Flexible hinge                     |
| 7           | Lip                                |
| 8, 9        | Wiper blade body longitudinal side |
| 10          | Longitudinal groove                |
| 11          | End cap                            |
| 12          | Airfoil surface                    |
| 13, 14, 14a | Profiled cover                     |
| 13'         | Projection                         |
| 14a'        | Face                               |
| 15, 16      | Longitudinal groove                |
| 17          | Projection                         |
| 18          | Space                              |
| 19          | Additional airfoil surface         |
| 20, 21      | Surface section                    |
| 22, 23      | Passage                            |
| 24, 25      | Nozzle orifice                     |
| 26          | Connecting hose                    |
| 27          | Longitudinal side                  |
| L           | Longitudinal axis                  |
| M           | Center plane                       |
| E           | Plane                              |